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Origin of "Aryabhata" and "Aryabhata's School"

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Introduction: Aryabhata had been so popular among the astronomers of the world that his work was translated into others languages. In spite of the uniqueness of the Indian astronomy, which had been more than a millennium ahead of modern astronomy and mathematics in content and subject matter, modern scholars and writers have alleged that the modern Indian astronomy as such was started and developed only in 5th century with the flooding of almost all-Indian astronomical works and astronomers[1]. Particularly, Aryabhata, Aryabhatiyam and Aryabhata School have been discussed much by the Western and Indian scholars, but most of the discussion based on the Secondary sources, as all of the works attributed to Aryabhata are not available. Some suppositions have been made about the personality of Aryabhata, his works, his school. native place, date etc., and such presumptions and assumptions later taken as authentic, in spite of generalizations made.

The work compiled from the later day commentaries and attributed to Aryabhata is no doubt an outstanding astronomical treatise in the form of sutra or aphorism, in which elaborate findings, details and data have been condensed, in a systematic way that is unique to Indian methodology. Definitely, it was handed over to the followers through generations of gurus or teachers and could not have been conceived, evolved, codified and written down in a particular period. Therefore, a critical study is made in this paper about the origin of "Aryabhata" and the School attributed to him. First, the different claims of origin of Aryabhata are discussed.

Aryabhata, Personality not found: The place of birth, education, and the details, how many years he lived, where he lived, where he established his schools, who were his disciples etc are not specifically known, but diversified details are culled down from the later day commentaries. Bhaskarai (622 CE) was the first commentator on Aryabhatiya and he refers to him as Bhata repeatedly (I.3, I.19). Other expressions used are ***Asmacharya Asmakacharya***, Srimadbhat (V.11), Acharyabhat (V.1), Aryabhata (VII..24) etc. Some scholars allude that he might or might not be a direct disciple and he never seen or met him during his time and so on, even though, the date of Aryabhata has been fixed as 476 CE and that of Aryabhatiya as 499 CE[2]. According to Jyesthadeva (1503 CE), Aryabhata was born on 499 CE and he wrote his work on 522 CE. Bhaskara I mentions Pandurangaswami, Latadeva (505 CE) and Nisanku were the disciples, who learnt astronomy at the feet of Aryabhata[3]. He refers to Aryabhata by the names Asmakatantra, Bhatesastra (I.40), Bhatatantra (VIII. 19) and Asmakiya and his followers by the designation Asmakiyah. Therefore, it is not clear as to whether, they actually studied under him or were just members/followers of Aryabhata School of astronomy, as only a few details are available even from the commentaries.

Tackling the Existence of Different Aryabhatas Aryabhatas:. Aryabhata an original Indian astronomer and mathematician must have been so popular in India and as well

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as outside India that many works were attributed and circulated in his name. Not only Bhaskara-I, but also Al-Biruni mentions about two Aryabhatas. And there are other Arvabhatas - Aryabhata of Aryabhatiya. Aryabhata of Arya-Siddhanta, Aryabhata of Ardharatrika System (Midnight Astronomy), Aryabhata of Four Cities, and Vriddha Aryabhata. Though, Bibhutibhusan Datta[4] has attempted to determine the relation between the two Aryabhatas of Al-Burni Aryabhata of Aryabhatiya, Aryabhata of the Arya-Siddhanta and Vriddha Aryabhata, specifically, clinched the issue, but concluded that Aryabhata of Kusumapura is a myth.

Aryabhata of Aryabhatiya: Aryabhatya has been written in Arya metre, aphorism - Sutra style, first discovered by Bhau Daji in 1884. From the internal evidence, scholars have decided that the author of this work is Aryabhata born in 475 CE and wrote it in 409 CE arrived (based on the verse- III Kalakriya 10). The name Aryabhata is mentioned at two places (I.1 and II.1) and the work Aryabhatiya in one place (IV.50). Though, the name Aryabhata is used, it is used only in third person and therefore, it is doubtful as to Aryabhata himself mentions about him as suggested or taken for interpretation by the scholars.

Aryabhata of Aryasiddhanta: Siddhanta works were so famous during 3rd to 6th centuries and such works and commentaries multiplied. The traditional Siddhantas are 18 in numbers attributed to 18 scholars. In Arabic, it was mentioned as Sind-Hind and translated into Arabic in 8th century CE. Of these, Surya Siddhanta (490 CE and 1091 CE-dates as per Ebenezer Burgess) and Arya Siddhanta attributed to Aryabhata were very famous. Though, the author of Surya Siddhanta is unknown, it is also attributed to Aryabhata, because of similarities noticed in the work. Ebenezer Burgess points out one Aryabhata, mentioned as ***Aryabhatta Mammabhatta***, who has written a commentary on Surya Siddhanta[5], the manuscript found among the Mackenzie collection and Wilson catalogue. Western scholars like Sewell, confused Aryabhata of Aryabhatiya with him and the work also.

Vriddha Aryabhata: He had authored the Arya Siddhanta following the orthodoxy of the Smritis. He clearly stated that his teachings were alike the teachings of Parasara and the two Siddhantas were written when Kaiyuga just passed (Maha Siddhanta. Chap.II, Verses 1-2). Jogeshchandra Roy opined that the Parasara Siddhanta was recast in the present form before the beginning of the Christian era i.e, 1st century BCE/CE, adding that the original Siddhanta was believed to have been composed many centuries earlier. Hence he concludes that Vriddha Aryabhata, in a probability, lived about that age, i.e, 1st Cent BCE[6].

The confusion among the western scholars about equating Vriddha Aryabhata with Aryabhata is evident from their works. For example, Robert Sewell[7] mentions that the first Aryasiddhanta, which was composed at Kusumapura (supposed to be Patna in Bengal), came into use from 499 CE. For this, S.B. Dikshit comments[8]:

> "***It is not to be understood that as soon as a standard work comes into use Its proceedings go out of use from all parts of the country. There is direct evidence to show that the original Surya Siddhanta was in use till AD 665, the date of Khanda-khadya of Brahmagupta, though evidently not in all parts of the country*.**"

Fitz-Edward Hall presented that "as reference is made in Arya Siddhanta Vriddha Aryabhata there should seem to have been two writers called Aryabhata[9].

John Bentley mentioned that his Aryabhata existed in 1322 CE. Bhau Daji so concurred with him. But, as Bhaskara - I 1114 CE) has alluded to him, he could not have lived in 1322 CE. Therefore, Vriddha Aryabhata might have existed around 1st cent.CE who wrote Arya Siddhanta on the lines of Parasara following the tradition of Smiritis.

Moreover, sutras type verses were very famous in all parts on India and they were quoted and translated as such in other languages also. It may be mentioned that even in Tamilagam, the works Tolkappiyam and Tirukkural are in sutra form.

Arvabhata of Kusumapura: According to the first verse of Ganita, Aryabhata speaks of knowledge that is worshipped or honoured at Kusumapure, but nothing is mentioned or even suggested that he belonged to Kusumapura or his school was there. It was Al-Binuni 1030 CE) who mentioned about two Aryabhatas –
1. The ***Elder Aryabhata*** and
2. The Younger Aryabhata of Kusumapura[10], who belonged to the Aryabhata School. Whie he does not identify the Elder Aryabhata with Kusumapura, Reinaud, Weber, Kern, Winternitz and Bhau Daji do so, relying upon the above mentioned verse[11]. The details available from different texts about Aryabhata of Kusumapura are as follows:

Aryabhata (499 CE) "Aryabhata sets forth here ***the knowledge honoured at Kusumapura*** (Ganita 1).

Parameswara (1431 CE): "Aryabhata sets forth ***in this country called Kusumapura, the knowledge honoured at Kusumapura***"

Raghunatharaja (1597 CE) "Aryabhata, ***while living at Kusumapura, sets forth the knowledge honoured at Kusumapura***.

The important fact to be noted here is that the commentators only changing the meanings and connotations of the quoted verses slowly during the course of time to impose their point of view.

Therefore, the change in interpretation occurred definitely, after thousand years. Hence the ***Elder Aryabhata or Original Aryabhata*** need not have hailed from Kusumapura. Had Aryabhata of 499 CE been there at Kusumapura, then. Brahmagupta (628 CE) and Balabhadra (665 CE) could not nave been his contemporaries as the works or

Balabhadra and Aryabhata of Kusumapura were translated into Arabic in 7th century CE. ***As Balabhadra could have written a commentary on Khanda-Khadyaka, both could have written commentaries on Aryabhatiya also***. As no commentators before Bhaskara-I mention about the Aryabhata of Kusumapura, Bibhutibhusan Data concludes that the Aryabhata of Kusumapura is a myth[12]. Moreover, as the Indian standard astronomical works were edited and updated based on the periodical observations made from time to time, it is evident that the observing disciples of the Aryabhata school must have been situated at different parts of India and Kusumapura might have been one of such centres.

Aryabhata of Pataliputra: Scholars argue that Aryabhata lived in Pataliputra equating Kusumapura with Pataliputra (a city of flowers it is also held that he wrote Aryabhatiya there, because, it was near to Nalanda University, Magadha, a great centre of learning and so on. But, even commentators have not specifically mentioned that Pataliputra was the same Pataliputra, the capital of Maghada. K.S. Shukla argues that as he was designated as kulapa = kulapati i.e., Head of a University, he might be a Kulapati of Naikanal University, which had an observatory.

Aryabhata of Asmaka: Another favourite interpretation of scholars is that Aryabhata belonged to Asmaka, though, Aryabhata mentions nothing about it in his Aryabhativa. As mentioned above. Bhaskara I refers to Aryabhata as an Asmaka implying that he was hailing from Asmaka area. According to Nilakanta (1500 CE), he was born in Asmaka Janapada[13]. K.S. Shukla has given an exhaustive discussion about the location of Asmaka[14], but come to a compromising stand that Aryabhata was an Asmaka who Ilved Pataputra (modern Patna) in Magadha (modern Bihar) and wrote his Aryabhata there[15]. Thus, here also presumptions and assumptions turned hypothesis resulted in a preposition that Aryabhata was an Asmaka and lived in Pataliputra. Therefore, the possibility is that Aryabhata school might have been existing at Asmaka, whether it is located in the north or south of India, because of its popularity as vouchsafed by the later day commentators.

Aryabhata of Kerala: The claim that Aryabhata was from Kerala, because his school has been so famous, is nothing but outcome and extension of Asmaka hypothesis, as some Sanskrit scholars have located Asmaka near Trivandrum. As most of the Kerala astronomers belonged to Aryabhata School and the manuscripts of commentaries available are also from Kerala, it is argued that Aryabhata was from Kerala. Thus, it has picked up well by others, mostly Malayalam writers to naturalize Aryabhata as a Keralite.

Aryabhata of Tamilnadu: Now, there have been claims that Aryabhata hailed from Tamilnadu. A.K. Bag mentions such claim[16] identifying Asmaka near Madras, Salem. He also notes about a Keralite writer's interpretation that Patalipuram is nothing but Sanskrit form of Puhar (Pumpuhan), an ancient port city of Tamilagam. K.K. Velukutty[17] equates with Varuchi (a Kerala astronomer) and Mosikiranar (a Tamil poet) and locates at Padalipura (Thirumalpuram) near Cuddalore in Arcot of Tamilnadu. He has made

many surmises and refixed the date of Aryabhata at 581 CE equating with Vararuchi and continues to mention Aryabhata as Aryabhatta in his book!

Thus, Aryabhata is located from north to south without any unanimity, as there is no specific mention about him in the immediate commentary. All the above claims are later interpretations, based on later date commentaries with a gap of more than 1000 years from the date fixed date of Aryabhata. Therefore, let us analyze the word Aryabhata to find out its meaning and connotation.

Aryabhata, the Name: The word Aryabhata is a combination of both Arya and Bhata common name used as honorific title. The word Arya, in both noun and adjective forms. denotes noble, honourable, gentle and so on

Bhata has the following connotations[18]:

Bhata (verb) –
1. to nourish, fester, maintain
2. to hire
3. to receive wages
4. To speak, converse

Bhata (noun). –
1. A warrior, soldier, combatant
2. A mercenary hired soldier, hireling
3. An outcast
4. .A demon

The word "bhatta" has different meanings as follows:

1. A lord, master (used as a title of respect in addressing princes).
2. A title used with the names of learned Brahmans
3. Any learned man or philosopher.
4. A kind of mixed caste, whose occupation is that of bards or panegyrists.
5. A bard, panegyrist

According to Monier Wiliams, Bhata[19] denotes -
1. to hire, nourish, maintain (v):
2. A servant, slave, kavyad
3. A humpback, of serpent-demon, Buddh.
4. Aryabhata
5. A degraded tribe

Thus, the personality must have been a combination of one or more of these characters. He might be a great scholar and hailing from a mixed or low caste. It may be mentioned that the word Bhata is used in derogatory sense and Bhatta in laudatory

sense in later days. To hide the derogatory nature of Bhata, the prefix Arya might have been used to become laudatory. That is why perhaps indian satellite was named as Aryabhatta instead of Aryabhata.

Vaghabhata (a physician.600-650 CE): Vetelabhata (one of the Nine Gems) had been famous during the Gupta period. In any case, Aryabhata as a whole is an honorific title, may denote a personality, teacher or a school itself as in the case of Vasishta, Vyasa, Sankaracharya etc., existed at different periods, but not to any specific personality of a particular period. Some scholars use the wrong word Aryabhatta to imply Aryabhata. but it has different connotations, as Bhata has different meaning, as pointed above.

White the usage of Arya has been since thousands of years mentioned both in Sanskrit and Tamil Sangam literature, it is evident that the usage of Bhata has been of later origin. Incidentally Bhatta a subdivision of Gauda Bhat - Telugu groups and Bhattar Tamil groups are still existing in South India. But, Bhat, Bhatia etc., of northern india, however, are different. Therefore, its popularity in South india is noted. As Arya had been so popular, it is quite possible that most of the astronomical works had been in circulation with that name or such title was purposely used for seeking recognition and authority. Therefore, the name Aryabhata itself must have been an honorific, respectable and venerable name, with all standard and important works attributed.

Aryabhatiyam Original Texts Not Found: As a great many of the quotations of Aryabhatas are second hand, for it appears that the original works were practically lost for centuries or the original works were neither available nor existed, but only in a much mutilated condition in the 14" century as noted by G.R.Kaye[20]. It is evident that the extant works might have been taken away by the Chinese, Arab and Christian Missionaries, as they were very much interested in collecting manuscripts scrolls, tables, charts etc sending them to their respective counties, as pointed out by themselves and getting translated into their languages for further study.

Bhau Daji who dealt with the age and authenticity of the works of Aryabhata, Varahamihira, Brahmagupta, etc, quoted a passage from the Maha Aryasiddhanta to the effect that the knowledge from the Siddhanta produced by Aryabhata, which was destroyed, in recessions by long time and hence, he (the, author of Maha Aryasiddhanta) had in his own language started specifying the rules.[21]

Al-Biruni [22] recorded that he had not been able to find anything of the books of Aryabhata, adding that what he knew of him was through quotations from him given by Brahmagupta (c.625 CE).

Colebrooke[23] opined that a long and diligent research in various parts of India failed of recovering the Algebraic and other works of Aryabhata.

Thibaut mentioned that the idea of earth rotating on its own axis was orginal and Aryabhata did not acquire such view from the Greeks, adding that he might have been

the first or one of the first to expound the principles of that system in a highly condensed and technical form and he might have improved the general theory in details. Particularly, he noted that ***the main body of doctrine existed before him and ne did not create it, but merely recant it in a different form***[24].

Therefore, the Aryabhatiyam, as available today might have been written by the original Aryabhata or a work attributed to the name or school, as it had been so popular during 5th – 6th centuries and thereafter, but original work existing earlier. Writing and composing new works with all available knowledge and updated data about a subject and circulating or attributing to a celebrated scholar or school has been a common practice not only in India, but also in other countries.

Aryabhata and His Four Cities: Aryabhata mentions four cities Lanka, Yavakoti, Siddhapura and Romaka situated at equal distance from Meru at 90° and on niraksha i.e, 0^0 latitude implying equator.

> "Just as a man going east by a boat sees a stationary thing as if it is going west, so do the fixed stars appear to be going straight westward at Lanka (IV. 9).
>
> "The frame of constellation with all the planets daily move straight westward at Lanka being thrown that way by the wind called Prabhava for producing their daily risings and settings (V.10).
>
> "What is sunrise at Lanka is sunset at Siddhapura, is noon at Yavakoti and a midnight at Romaka" (IV. 13).
>
> "Lanka is midway between the land and water hemispheres, is at one-fourth of the circumference of the earth from the pole and Ujjain is at one-fourth of that quadrant straight towards the north IV.14 (All translations are from PC Sengupta).

Here, much importance given to Lanka by Aryabhata is to be noted. Aryabhata or the author of the work attributed to Aryabhata could have mentioned these details, had he not been there to observe the exact position. When Lanka was so important for the astronomical purposes and how it was connected with other astronomical places are also to be analyzed critically. From IV. 13, is evident that Lanka and Siddhapura are situated exactly opposite to each other on the globe and so also Yavakoti and Romaka, and all the four cities on the equator at equal distance from the Meru. These concepts are found in Surya Siddhanta I.53, II.43. XII.37-41, 52, 70, 71 and XIII.14).

Particularly, the verses XII.37-41 of Surya Siddhants are repeatedly appearing in the works of Aryabhata, Bhaskara and others. They are quoted just like some laws. Therefore, the 4th century to 12th century astronomers definitely knew that the cities an mentioned were not exactly situated as mentioned by the authors of Surya Siddhanta or tater by Aryabhata.

Therefore, at the time of the writers of Surya Siddhanta and Original Aryabhatiyam, the cities have been situated on the equator at equal distances and at 90° to its axis from the Mount Meru. After that because of the changes in the landmass, due to plate tectonic processes and sea level rises, the Lanka of that period must have disappeared. That is why modern commentators dub them as imaginary cities situated on the equator (PC. Sengupta etc). Had they been imaginary cities, the observations made and the astronomical calculations given would not tally.

Otherwise, the possibility is when Aryabhata observed exactly as he stated in his verses, that he should have existed at the time when those cites existed exactly at 90° to the axis of Meru and equal distance from each other. Though, scholars differ in identifying the three cities Yavakoti, Romaka and Siddhapura, they agree with the Identification of Lanka with two options, one group of scholars identifying with the present Sri Lanka and the other group with that of Lanka situated on the niraksha 0^0 latitude i.e, equator.

Here, the identification of Ramyan Lanka with that of astronomical Lanka is significant to be noted for verification, as to whether both are one and the same or the astronomical Lanka is just an imaginary place marked on the globe for calculation of time and distances. Incidentally, based on the planetary position at the time of birth of Rama and other descriptions provided in the Valmiki Ramayana, the date of Rama has been fixed as 4433 BCE[25]. In Mahabharat, there is a verse, which says that Hastinapura, Avanti Kanyakumari and Lanka were all in the same longitude. But they were not like that even 2000 years back, when the present Sri Lanka (Ceylon) get separated from India. Therefore, the Ramayan Lanka must have been different from than present Sri Lanka and it is rightly located on the equator.

Robert Sewell[26] notes that Lanka is not Ceylon, but a place supposed to be on the equator, or at 0^0 0' 0" on the meridian of Ujjain, or longitude 95°46'.

John Playfair[27] records, that-

> ".…….from a Hindoo map, in the Ayeen Akbery, vol.iii, p.25 Lanka appears to be an island which marks the Intersection of Cape Comorin, with the equator and is probably one of the Maldive islands. See also a note in the Ayeen Abery, Ibid. p.36.

Therefore, the astronomer made such observations during a particular time and records in his work, it is evident that he must have existed during the period. Accordingly the Aryabhate tradition of astronomy must have originated between 4433 BCE and 2000 BCE. particularly in the South.

Aryabhata of Midnight Astronomy: The Ardharatrika system (Midnight astronomy) of Aryabhata was followed in India till Brahmagupta (628 CE) introduced Khanda-

Khadyaka. Bhaskara describes attributing to Aryabhata in his Bhasya (VII. 21-35), but no work is available. From the references available in other works, it is evident that Aryahhata would have written such a work. In the beginning of Khanda-Khadyaka Branmagusta says. "***Vakshyami khanda-khadyakam acharyabhata tulyapalam***". As such remarks do not apply to the extant Aryabhatiyam, it is evident that he was referring to an extinct work of Aryabhata, which talked about Artharatrika system. Varahamihira explicitly mentions in Pancha Siddhandika (XV. 20):

"***Lanka artharatra samya dhinpravrutim jagadh acharyabhataha***
Bhuyaha: aiva suryodhaya atprabrutyaha Lankayam"

The days begin from midnight (ardha-ratri) unlike Aydayika system, in which days begin from sunrise (udaya). As the computation of Latitude and yojana measure of Ardharatrika system have been unique, as noted by the commentators, it is evident that the system of Aryabhata is much earlier to Aryabhatiyam. As pointed out above as the Aryabhata of Ardharatrika system gives much importance to Lanka and the four cities situated on niraksha, he must have bean hailing from the South or Lanka itself for making such observations.

Al-ntf or al-nanf: It is the name of a small work mentioned by Al-Biruni attributed to Aryabhata of Kusumapura, but neither traceable nor recognized. This shows that several works had been in circulation attributed to Aryabhata. As during the period 750-850 CE, many Indian astronomical and mathematical works were translated into Arabic from Persia or directly from Sanskrit, it is evident that manuscripts must have gone with Indian scholars or for the scholars at Arabia. Al-ntf must have been one of such works attributed to Aryabhata. From 9th century onwards, it was mentioned by Abu Rayhan al-Biruni.

Ayanamsa, Chronology and Fixing Dates for Astronomical works: The act or rate of precession is called Ayana-calana and the amount of precession accumulated thereby is called Ayanamsa. Ayanamsa is the precession or a correction for the accumulated procession for the years calculated.

The Surya, Brahma Soma and Vriddha Siddhantas, and later Siddhantas and Karanas give rules for Ayanamsa and make it clear that the ayanams was zero ie. Vernal equinox and the starting point of Mesha coincide with each other at the end of 3800 Kall or 499 CE. At the time of Aryabhata, Lalla, Varahamihira and Bhaskara, the Ayanamsa was zero, though it was not mentioned in their works.

Scholars quote that Lalla (c.500 CE) cites Aryabhata, when he says that "Bhatodhita" meaning as mentioned by Bhata, while mentioning about the 24 Hsines. Though, Aryabhats is not specifically mentioned, Bhata is implied as Aryabhata. Could it be possible for Lalla to quote Aryabhata immediately within a year or was he quoting from the work of another Aryabhata existed earner?

Munjula wrote Laghumanasa in 932 CE giving ayanamsa for 932 CE as 6° 50'. This presumably the amount of precession accumulated since Varahamihira prepared the corrected calendar around 500 CE. Therefore, this data tallies with the dates of others indicating that only the works attributed to the respective scholars were corrected and not that the works actually written by them. Particularly, it is well known that no work of Aryabhate was available, but his quotations were copiously cited in their works.

John Bentley[28] fixed 51 CE, 292 CE and 632 CE as the commencement of the sixth, seventh and eighth astronomical periods for Hindu astronomy respectively. L.D. Swamikkannu Pillai fixed 536 CE as the year of Zero Ayanamsa and fixed the date of Varahamihira. This is in contrast to the Zero Ayanamsa found by the Indian astronomers as given below:

Name of Astronomer	**Saka year**	**Current Era**	**Seconds as the rate per year**
Surya Siddhanta	421	499	54
Aryabhata	421	499	50
Varahaminira	427	505	47
Kalidasa	445	523	
Baskararacharya Suryadalvagna	412	490	60
Author of Ganakanandam	421	499	50
Bhaskara	528	600	50.5

Ayanamsa is taken the zero or nearly.zero.during the period.500-600 CE by the scholars and they try to fix the dates of Important Indian astronomers in this period. This approximation is wrong, as even a second makes difference in astronomy chronologically. If this is the case, the dates of all works can be fixed at 499 CE, when the ayanamsa was exactly zero. However, the important point is that the astronomical works were corrected by the predecessors or followers, according to the observations made by the astronomers of their periods.

Most of the original works are not available, and from the copies of later data and secondary sources, they have been reconstructed by preparing critical editions. Therefore, the date of the manuscript or the date obtained from the verses given in the works or the date determined based on ayanamsa cannot be a basis for fixing the date of authors themselves.

Interestingly, Aryabhata (499 CE), Lalla (500 CE) and Varahamihira (505 CE) have been made contemporary based on their works attributed to them. As Surya, Brahma

Soma and Vriddha Siddhantas and later Siddhantas and Karanas give rules for Ayanamsa and make it clear that ayanamsa was zero i.e., Vernal equinox and the starting point of Mesha coincide with each other at the end of Kali 3000 or 499 CE can all the works and the personalities attributed to be the authors of these works be dated to 409 CE? Both Western and Indian scholars have done so. According to Bentley, the authors of Arya-Siddhanta, Brahma-Siddhanta and Parasara-Siddhanta lived in 1322 CE and Varahamihira in 1528 CE[29].

Colebrooke has pointed out that some of the ancient writers on astronomy had not admitted a periodical motion of equinoxes (as admitted by Bhaskara himself), he agreed that concept was there in India introduced by Aryabhata. Accepting the antiquity of such system, he concludes that[30],

> "***……on the subject of the precession of equinoxes, the Hindus had a theory, which, though erroneous, was their own***".

But, it is pointed out that in the commentaries, the difference is bound to occur as both corrected and uncorrected works might have been in circulation simultaneously. As the ayanamsa is stressed in these works occurred in 499 CE, whether that date can be the date of the works or authors has to be analyzed carefully.

Meaning and interpretation of the Verse 10 of Kalakriva of Aryabhativa: The verse simply says –

> "***When sixty times sixty years and three quarter yugas had elapsed, twenty three years had then passed since my birth***"

From this the date of Aryabhata is fixed as 3000-3101-499-23-470 CE

In such attempt, the following assumptions are made:

1. Though 3600 years had elapsed has been mentioned. Kaliyuga is not mentioned specifically.

2. The Kaliyuga or Era started in 3101 BCE.

3. Though nothing is mentioned about i.e-Sake-era-78-verse are deducted.

4. Though sixty times sixty years and three quarter yuges had elapsed is mentioned, only 3600 years are taken and three quarter yuges are not taken into account!

5. Again the significance of three quarter yugas is never discussed by the translators and commentators as to whether it is ¾ of the yugas or Kaliyuga alone.

This stanza mentions the epoch when 3600 years had elapsed since the beginning of the current Kaliyuga and it corresponds to mean noon at Ujjain, Sunday, March 21, 499 CE. Here, commentators mention Kaliyuga to imply that at that time the mean positions of the planets computed from the parameters given in the Dasagitika sutra, it did not require any correction. In fact, according to Suryadeva (1191), Raghunatha-raja (1597). Visvanatha (1629), the author of the Vakya-karans, the time when the precession of the equinox was zero coincides with 499 CE.

But, according to another group of scholars Brahmadeva (1092 CE). Bhoja (1042 CE). Ganesha Daivajna (1520 CE), Manjula (932 CE), and author of Laghu-manasa and followers of Khanda-Khadyaka have regarded Saks 422 or 499/ 444 or 522 CE as the epoch when the precession of the equinoxes was zero. It is important to be noted that Haridatta (c.683 CE) fixed the date of Aryabhata to 499 CE and Aryabhatiya to 522 CE based on this interpretation. Therefore, he might have followed the later system.

Robert Sewell gives interesting details about Kall Year 3600, while discussing about Mesha Sankarananti[31]:

> "***According to the present Surya Siddhanta, the sidareal coincided with the tropical signs in K.Y 3600 expired, Saka 421 expired and the precision is 54. By almost all other authorities the coincidence took place in KY 3623 expired, Saka 444 expired, and the annual precession is (1") one minute (The Siddhanta Shiromani, however, fixes this cuincidence as in KY 2628***".

The K.Y 3600 = Saka 421 = 499 CE and KY 3823 = Saka 444 = 522 CE have been very familiar, as these dates are nothing but the date of Aryabhatiyam according to two interpretations as pointed out above.

Therefore, a doubt arises as to whether the author of the work attributed to Aryabhatiyam actually mentions about his age or the precession of equinoxes at that time. Incidentally, the author discusses about the subject in the previous verses as follows[32]:

1. A year consists of 12 months, a month 30 days, a day 60 nadis, and a nadi 60 vinadikas or vinadis.

2. A sidereal vinadika is equal to (the time taken by a man in normal condition in pronouncing) 60 long syllables (with moderate flow of voice) or (in taking) 6 pranas / respirations. This is the division of time. The division of a circle (literally the ecliptic) proceeds in a similar manner from the revolution.

3. The difference between the revolution-numbers of any two planets is the number of conjunctions of those planets in a Yugs. The (combined) revolutions of the Sun and the Moon added to themselves is the number of Vyatipatas (in a Yuga).

4. The difference between the revolution-numbers of a planet and its ucca gives the revolutions of the planet's epicycle (in a Yuga). The revolution-number of Jupiter multiplied by 12 gives the number of Jovian years beginning with Asvayuk.

5. The revolutions of the Sun are solar years. The conjunctions of the Sun and the Moon are lunar months. The conjunctions of the Sun and Earth are (civil) days. The rotations of the Earth are sidereal days.

6. The lunar months (in a yuga) which are in excess of the solar months (in a yuga) are (known as) the intercalary months in a yuga; and the lunar days (in a yuga) diminished by the civil days (in a yuga) are known as the omitted lunar days (in a yuga).

7. A solar yeer in a year of men. Thiry times a year of men is a year of the Manes. Twelve times a year of the Manes is called a divine year (or a year of the gods).

8. 12.000 divine years make a general planetary Yugs. 1008 (general) planetary yugas make a day of Brahma.

9. The first) half of a Yuga is Utsarpini and the second half Aparsarpini. Susama occurs in the middle and Dusama in the beginning and end. (The time elapsed or to elapse is to be reckoned) from the position of the Moon apogee

Therefore, if anybody reads the verses together, it is very clear that the author talks about the calculation of time based on planetary revolution, conjunction etc. Though, the name Aryabhata appears at two places (I.1 & II.1), nowhere, the author discusses about his personal details. Therefore, it is evident that the tenth verse mentions about the precession of equinoxes coinciding with a zero ayanamsa rather then the date of the author occurring on March 21, 493 CE (Mesha Sankranti day, when Sun enters Tula rasi), as interpreted.

The Clustering of Astronomers and Their Works Around 499 CE: Bentley asserts that none of the Hindu artificial systems are ancient, they are all since 538 CE, the year in which the modern astronomy commenced and not at the beginning of the Kaliyuga KY) as imagined by Bailly or others[33]. Indian scholars like P.C. Sengupta also opined that the year 421 Saka era or 499 CE was the date of Hindu scientific astronomy from which all calculations started according to the Aryabhatiya and the modern Surya Siddhanta[34]. According to him, Surya Siddhanta was introduced into India from Rome and other astronomical works and principles from Babylon and Greece between 100 CE and 400 CE[35] and that is why there was sudden surge of astronomical activities during 5th -6th centuries.

According to Nityananda (c.1639), the author of Siddhanta-raja, the date of composition of the Surya Siddhanta was 499 CE, as was composed when 3600 years of Kali

elapsed. Burgess assigns 490 CE as the superior limit and 1001 CE lower limit based on Bentley's table[36]. ***According to modern Surya Siddhanta, the total procession from the beginning of Aries / Mesha at this date was equal to zero. According to the rule of this modern book, the ayanamsa or the total precession and It happened in the year of 499 CE. It has already been mentioned that the date of Aryabhatiyam is placed in 499 CE. Varahamihira was supposed to have corrected Indian calendar around 500*** CE[37]. Lalla is placed in 499 CE. Therefore, one has to look into these conglomeration of personalities, their works and astronomical events taking place around 499 CE is a fact, or mere coincidence or purposely made to imply that the Indian astronomical works were borrowed from the Greeks or Babylonians and so on.

L. D. Swamikkannu Pillai started with vernal equinox at 6 am on 21st March 499 CE. The Kall years taken 3800 is based on the length of the sidereal year as 0.0023182 days. The difference in 3600 years comes to 8° 23' and this is Bentley's figure on the Varahamihira's Zodiac. This is 18° 21' on the zodiac of 285 CE adopted by the Government of India. This error accumulates negatively before 499 CE and positively after 499 CE. Therefore, clustering of astronomers around 499 CE appears to be artificial and not historical.

An Important Historical Discussion: Ironically, the Guptas were ruling between 320 and 600 CE and it is considered as Golden period of Indian history! The Sanskrit literature flourished with great vigour covering all fields of sacred and secular aspects of society. Many compendiums, Nigandus and Koshas were compiled. The Nine Gems were reportedly adoring the court of Chandragupta Vikramatidya (380-414 CE) and they were Dhanvantri, Kshapanaka, Amarasimha, Sanku, Vetalabhata, Ghatkaarpara. Kalidasa, Varahamihira and Varuchi (Jyotirvidabharana 22.10) with expertise in their respective fields. Skanda Gupta was ruling between 455 and 400 and his successors up to 600 CE. We note Varahamihira and Varuchi figuring in the list. Then, why Aryabhata was left out? Had Aryabhata been so popular or actually existing during the material period, definitely, he would have been included in the list of Nine Gems. This is direct evidence to prove that Aryabhata never existed in the material period. As Varahamihira and Varuchi had been popular, it is clear that only Aryabhata School was popular. Therefore, during this Golden Period, Indian scholars need not have copied or borrowed ideas, knowledge or their astronomical works to be adapted and adopted into Sanskrit.

Conclusion: From the foregoing, the following conclusions are drawn:

1. Aryabhata of original Aryabhatiyam might be different personality from that of Aryabhatiyam of 499 CE. He can be designated as Original Aryabhata or Adi Aryabhata.

2. The name Aryabhata is a common name and therefore connotes to a lineage of School, just like Vyasa, Vasishta, Sankaracharya, etc.

3. The work of Adi Aryabhata must have been handed over to the disciples and the present Aryabhatiyam must be a compilation, as still many verses are not translated, as they are elliptical, obscure and so as noted by the translators and commentators.

4. Definitely, the year 499 CE has astronomical significance, but it cannot be made at sheet anchor of Indian astronomy.

5. As original works of Siddhantas are not available, with the available Surya Siddhanta and other Siddhantas attributed to traditional authors, they cannot be brought down to the bracketed period

6. It is evident that the Indian astronomical works have been continuously amended with new observations and data, but the date of corrections cannot be taken as date of the works themselves.

7. As they texts were amended in 499, when ayanamsa was zero, they appear, as if they were written in 499 and the authors existing in 499 CE.

8. As the existing system was amended and or replaced by the new one with corrections, the scribes while copying the texts, must have made mix-up of the two systems leading to certain differences as noted and exploited by the western writers. The concept of precession of equinoxes or ayanamsa is traceable back to Vedio period and therefore, its mention in the Surya Siddhantas and other works is not an interpolation as alleged by the western writers.

9. The forced clustering most of the famous astronomers like Aryabhata, Lalla, Lata. Vatahamihira etc in the bracketed period is artificial and cannot be historical, as chronology does not help for such an attempt as proved above.

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